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ABSTRACT

In the light of low completion rates in the basic mathematics course, MTH 100, at Brookdale Community College, a study was conducted to ascertain the factors associated with success and failure in the course. A questionnaire, designed to obtain demographic data and weighted information on students' attitudes to mathematics, was distributed to 937 students enrolled in MTH 100 in fall 1982. Based on responses from 603 students, study findings revealed: (1) the overall pass rate for the course was 48.8%, with women having a higher pass rate (54.3%) than men (40.9%); (2) the pass rate for men aged 20 to 22 years was 31% and for returning women was 70%; (3) the pass rate for students taking 3 credits or less was 60%, while that for students taking between 10 and 12 credits was 46%; (4) the lowest pass rates occurred among students working between 0 and 12 hours per week (41%), while the highest rate was found among those working 31 to 40 hours per week (58%); (5) a very positive attitude towards mathematics correlated strongly with success in MTH 100, though a negative attitude did not correlate strongly with failure in the course; and (6) combined credit and work load was not significantly related to course success. The survey instrument is appended. (HB)

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MATH 100 SURVEY

FALL 1982

BROOKDALE COMMUNITY COLLEGE

Ruth Goldston

November 1983

JC 830 533

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RESULTS OF MTH 100 SURVEY
by Ruth Goldston

Introduction

The basic mathematics course at Brookdale, MTH 100, has been a source of great frustration for teachers, counselors, administrators, and students. The course completion rate has been a little less than 50%, well below that of the companion developmental courses in reading and writing. Questions naturally arise about the causes of students' difficulties in completing MTH 100. Do attitudes make a difference? Can students in other developmental courses handle MTH 100 concurrently? What about work commitments outside school? Are younger students better prepared? Should we offer more support to our returning women? Among the College staff, answers to these questions are quite varied, depending on the experience and personal style of the observer. Therefore, it made sense to try to find out in a more systematic way what kinds of factors were associated with success or failure in the course, especially in light of the revision of its objectives and methods for the 1983-84 academic year.

In order to do this, a questionnaire was distributed to all students enrolled in MTH 100 during the first week of classes in the Fall 82 term. The questionnaire (appendix 1) was designed to survey the population of students taking the course to determine some of its basic "demographic" characteristics (e.g., age, sex, prior math background.) In addition, the questionnaire contained statements about attitudes toward mathematics to which students responded on a scale indicating extent of agreement. After the end of the Fall 82 term, students' grades in the course were collected and added to the questionnaire data. The data were then analyzed to determine what, if any, demographic chacteristics and/or attitudes correlated with success in MTH 100. This report summarizes

some of the more striking findings from the analysis.

Method

The questionnaire data, including final grade, were all coded and entered into a computer data base as individual records. Some questionnaires were discarded because they were incomplete or because there was no final grade available (in some cases, for example, students had switched into MTH 118). Some students who were enrolled in the course and who did receive final grades did not complete questionnaires, probably because they were not present when the questionnaire was distributed. Other than these omissions, the results presented here are based on the total remaining sample of 603 questionnaires, out of a total MTH 100 enrollment of 937. Due to the nature of Brookdale's grading system, most of the results are reported here in terms of "pass (completion) rate", i.e., the combined percentage of students in a given category who received grades of Cr, CH or CHH. The "withdrawal (drop) rate" represents the combined percentage of students who received grades of WIA, WAS or WBP. Grades of DCR are not included in either category since they represent an uncertain outcome (probably most of DCR's have since become WAS grades as is the case throughout the college).

The data on attitudes were entered as scores of 1 (Strongly Disagree) to 5 (Strongly Agree) on each item. A composite attitude score was calculated for each student on the basis of these responses. The students' responses (1....5) to each question were converted to a scale of (-2....+2), where -2 indicated a negative attitude towards mathematics, and +2 indicated a positive attitude. The converted responses were then summed for the 19 questions used.. Thus a composite attitude score of Ø indicates a net neutral attitude. Since there were 19 questions used in this composite, a score of 38 is the maximum positive attitude,

and -38 is the most negative. Most (87%) responses were in the range -7 to +7. While this method does not distinguish truly neutral attitudes from a balanced combination of positive and negative attitudes, it should be sensitive to more extreme positive or negative sets of attitudes.

Results

The overall pass rate (P) in the sample is 48.8%; the withdrawal (W) rate (excluding DCR's) is 46%. Among men, P=40.9% and W=53.6%, while among women P=54.3% and W=40.6%. Women, therefore appear to have a slightly better chance of completing the course than men do.

Age and Sex

Figure 1 shows P/W rate distribution by age and sex. First of all, note that more than 2/3 of he students in MTH 100 are in the two youngest categories (age $\angle$ 23). The pass rate for younger women most closely corresponds to that of the whole sample (P=48%). Among men, the poorest pass rate is found among men in the 20 - 22 age range (P=31%). As a whole however, the total pass rate for sample of men does not change drastically with age; the younger ($\angle$ 23) men pass at a slightly lower rate (P=41%) than the older (23-59) men do (45%). The most striking result is in the "returning women" category. Among these women (ages 23-59) the pass rate is 70%, significantly higher than that of the sample as a whole or that of any other age-sex category. Since these students are more likely to express concern to teachers and counselors about their ability to pass the course, this statistic may be helpful in reassuring them.

Last Math Course

As can be seen in Figure 2, pass rates increase more or less steadily as the level of the "last math course taken" rises. More than 1/3 (N=221) of the students report that general or Business Math was their last math course.

Figure 1. PASS RATES : Age and Sex

Age	Number in Sample (n)	Pass Rate (P)	MALES	Sample (n)	Pass Rate (P)	FEMALES
<19	161	43%	Combined (<22) n = 197	195	48%	Combined (<22) n = 245
20-22	36	31%	P = 41%	50	48%	P = 48%
23-29	32	44%		50	68%	
30-39	12	50%	Combined (23-59) n = 51	26	77%	Combined (23-59) n = 98
40-49	3	33%	P = 45%	13	69%	P = 70%
50-59	4	50%		9	66%	

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Figure 2. PASS RATES : Last Math Course Taken

Math Course	n	Pass Rate
General or Business Math	221	43%
MTH 100 at Brookdale	63	44%
Algebra I	84	45%
Geometry	117	56%
Algebra II	60	68%
Trig/Math Analysis	16	56%

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Transportation

The vast majority of MTH 100 students drive their own cars to school and, not surprisingly, the pass rate among these students closely resembles that of the total sample. The best pass rate appears among students who report that they share a car with a least on other person (58%). The worst pass rate is found among those students who had made no regular arrangements yet (25%); however the sample size here is small (N=12). For students who use public transportation, the pass rate is 42% - somewhat lower than that of other categories.

Developmental Courses

Figure 3 shows the pass rates for MTH 100 students who report concurrent enrollment in REA 100 and/or ENG 100. Pass rates for students who enroll in only <u>one</u> of these courses along with MTH 100 do not differ significantly from those of students who are in neither REA or ENG 100:

P(REA 100 only) = 54%

P(ENG 100 only) = 52%

P(Neither REA 100 or ENG 100) =53%

However, students who take REA 100, ENG 100 and MTH 100 all together have a much lower pass rate: P(REA 100 and ENG 100) = 33%.

Credits Enrolled

Figure 4 shows the MTH 100 pass rates for students according to the total number of credits enrolled in Fall 82 (as of the first week of school). The pass rates decline steadily as the credit load increases, though the decline is slight between 7 and 13+ credits.

Hours Work/ Week

Figure 5 shows pass rates for MTH 100 students according to number of hours worked per week. It is interesting that the lowest pass rates occur among students who work the fewest hours.

P (0-12 hrs) = 41% < P(0 hrs) = 45%
P(1-12 hrs) = 37%

Figures 3. PASS RATES : Concurrent Enrollment in REA 100 and/or ENG 100

	In REA 100	Not in REA 100	In ENG 100	Not in ENG 100
In REA 100	40%*		33%	54%
Not in REA 100		53%**	52%	53%
In ENG 100			41%*	
Not in ENG 100				53%**

*Overall rates, including students who are in one of the courses and students who are in both.

**Overall rates, including students who are in the other course and students who are in neither course.

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Figure 4. PASS RATES : Number of Credits Enrolled, Fall 1982

Number of Credits	n	Pass Rate
∠3	47	60%
4- 6	83	54%
7- 9	72	49%
10-12	223	46%
13+	175	47%

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Figure 5. PASS RATE : Total Hours Work/Week

Hours Work/Week	n	Pass Rate
0	100	45%
1- 6	57	39%
7-12	58	36%
13-20	123	55%
21-30	116	49%
31-40	76	58%
41+	49	55%

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P(13-40 hrs) = 54%

Note, however, that students who don't work at all do slightly better as a group than those who work 1 - 12 hours per week.

Combined credit and work load

Since for so many of our students, "time available" appears to be a critical factor in course completion, it seemed worthwhile to look at the pass rates for students according to their combination of credit load and work commitment. These are displayed in Fig. 6. There does not appear to be a systematic correlation here, though the effects of the individual factors, as described above, are evident. Also, small samples in some of the cells make the pass rates of questionable significance. Given these limitatiaons, however, it is interesting to note that students who work 31-40 hours per week pass the course at better than 50% rates consistently, even when taking 10 - 13+ credits. (Note that this group has the highest overall pass rate). Students who work more than 40 hours/week maintain a 50% or better pass rate through a 7 - 9 credit load and then drop off (through the sample sizes for this group are perhaps too small to be meaningful). The lowest pass rates, as noted above, occur among students who are working 1 - 12 hours per week, with no evident systematic relationship between credit load, work commitment, and pass rate.

Attitudes

Figure 7 displays the pass rates for students according to composite attitude score, both for the total group and by sex. The most striking effect appears at the positive end of the scale: in all groups, pass rates increase dramatically as the attitude score rises past a certain positive value (>10). There is no corresponding effect in the overall group at the lower (more negative) end of the scale, although among the sample of men, there may be a significant correlation between a negative

Figure 6. PASS RATES : Combined Credit Load and Work Commitment

n = number of students
P = pass rate (%)

Credits	Work Hours Per Week						
	0	1-6	7-12	13-20	21-30	31-40	41+
< 3	n = 2 P = 50	n = 8 P = 75	n = 4 P = 75	n = 6 P = 66	n = 7 P = 57	n = 6 P = 50	n = 12 P = 58
4- 6	n = 4 P = 50	n = 12 P = 25	n = 8 P = 37	n = 4 P = 75	n = 7 P = 57	n = 22 P = 59	n = 24 P = 63
7- 9	n = 6 P = 16	n = 6 P = 33	n = 8 P = 37	n = 15 P = 40	n = 15 P = 66	n = 15 P = 53	n = 4 P = 50
10-12	n = 48 P = 44	n = 18 P = 33	n = 24 P = 42	n = 49 P = 49	n = 50 P = 46	n = 19 P = 63	n = 5 P = 40
13+	n = 40 P = 50	n = 13 P = 38	n - 13 P = 15	n = 49 P = 63	n = 37 P = 43	n = 13 P = 54	n = 4 P = 25

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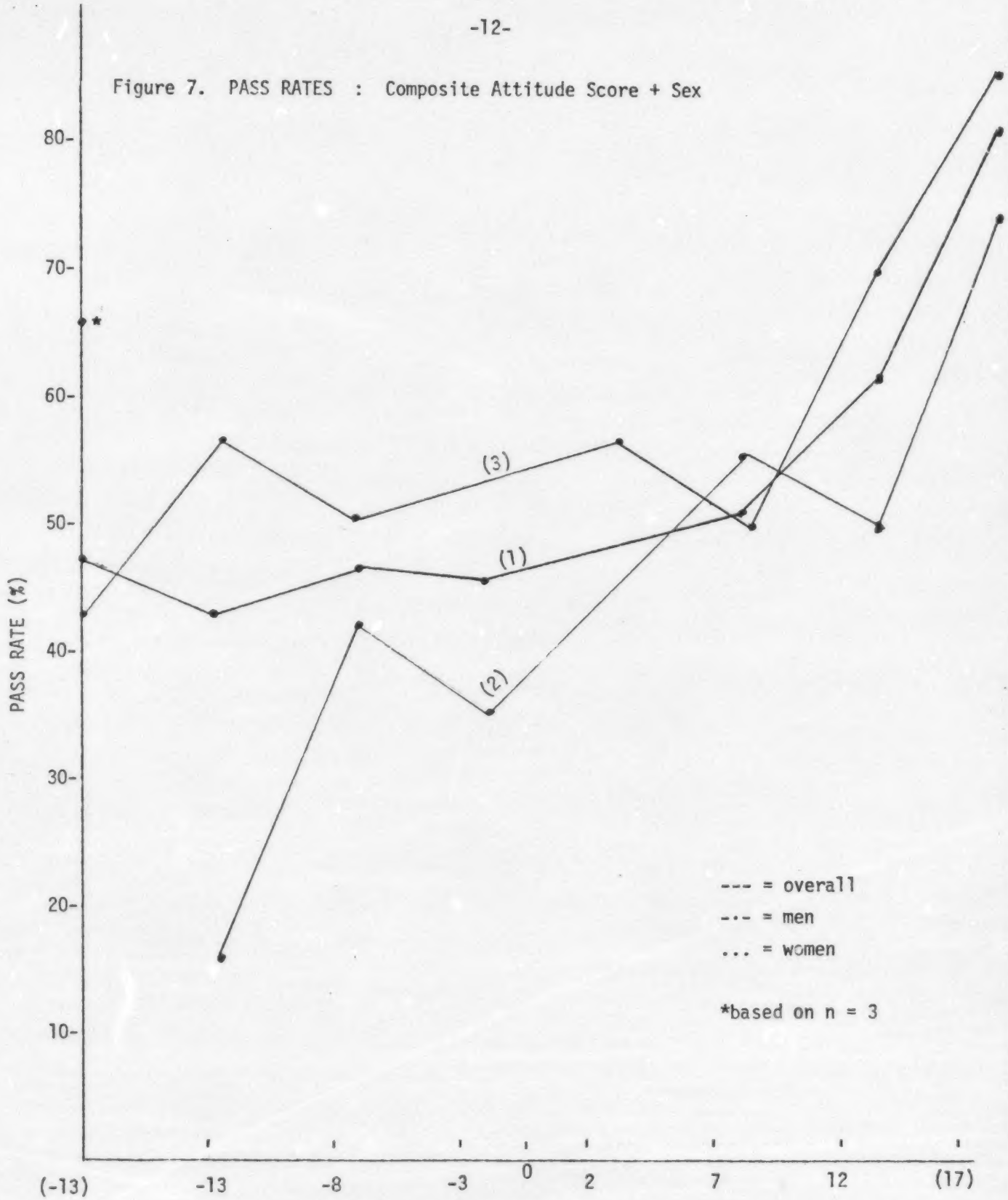
Figure 7. PASS RATES : Composite Attitude Score + Sex



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attitude score and a lower pass rate. It appears, then, that while a more "negative" attitude, as measured by this method, does not systematically determine pass rate, a more "positive" attitude does seem to correlate strongly with a higher chance of success in the course.

Discussion

What does it all mean? What else might we want to know? And what do these findings imply about future revisions to the MTH 100 course? We may want to speculate as to some of the causes of the more striking results. For example, why does the group of older women do so much better in MTH 100 than other groups? Is it maturity, ability, motivation, or a combination of all of these? If so, what, if anything can we do to strengthen these qualities in other students? If students with very positive attitudes succeed more often, what can we do to help all students develop these attitudes? And if there exists a threshold of basic skills that is essential to passing MTH 100, how can we make sure that students taking the course are properly prepared for it?

We will need teaching and counseling approaches that work with younger students of both sexes who comprise the vast majority of the MTH 100 population. For many of these students, failure to complete MTH 100 is part of a larger pattern of withdrawals from courses that could be symptomatic of a number of difficulties. This group deserves college-wide attention. However, perhaps we should focus our efforts on another group - those who are able to pass other courses but who do not pass MTH 100. Data on this group were not readily available, but it would certainly be useful to know more about the factors that distinguish this group from students who do succeed in MTH 100.

The data unfortunately do not include students' scores on

the New Jersey Basic Skills Test, which may be a predictor of success especially for some groups within the population. Also, it would be interesting to know more about the pass rates among students who have already completed other developmental course work before taking MTH 100. If students who have completed, for example, REA 100, prior to MTH 100 have significantly better pass rates than those who take it concurrently, we may want to require REA 100 as a prerequisite. The evidence so far suggests that taking a single developmental course along with MTH 100 does not change the completion rate, but that taking all three courses together is not a promising combination for success in MTH 100. Perhaps we can identify a threshold of basic skills that students need to posess before entering MTH 100, and use this information to place students in the course at an appropriate time.

The attitudes survey could be a useful tool for assessing need for study skills, level of anxiety and/or confidence for learning mathematics, degree to which math is perceived to be useful and/or relevant, and level of motivation to succeed. Unfortunately it is not a well documented instrument for determining these things. There do already exist some tools for reliable and valid measurement of a range of attitudes towards mathematics * which we may want to consider for further research and perhaps for assessment devices as a routine part of the course. The evidence suggests that it may be worthwhile to find ways to increase students' positive attitudes about math, since this seems to correlate with a higher pass rate.

* Fennema-Sherman Scales and Math Anxiety Rating Scale (MARS)

Conclusion

The most striking deviations from the overall pass rate of 50% in MTH 100 occur in the following groups:

1. Older women (ages 23-59), where P=70%
2. Students who have high (>10) scores on a survey of attitudes towards math, indicating a very positive attitude (P=60-79%)
3. Students who take both REA 100 and ENG 100 along with MTH 100 (P=33%)

Other findings include

1. Women have a slightly higher pass rate (P=54%) than men do (P=41%)
2. Students who work only a few hours per week have a slightly lower pass rate (P=37%) than students who do not work at all (P=45%) or students who work more (P=54%)
3. Older men (ages 23-59) have a slightly higher pass rate (P=45%) than younger men (P=41%); the poorest pass rate among men occurs in the 20-22 age range (P=31%)

Teaching and counseling approaches oriented toward the factors that cause these differences may improve completion rates. Directions for further research might include incorporating scores on the New Jersey Basic Skills Test into the demographic data and the administration of standardized measure of attitudes toward mathematics. Also, it would be worthwhile to be able to identify the group of students who pass other courses but who do not pass MTH 100, in order to compare it to the group that does complete the course. Finally, further study of the population of students who take basic mathematics may reveal how some of the revisions to the course are working.

Acknowledgments

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APPENDIX

SURVEY QUESTIONNAIRE

MATH QUESTIONNAIRE

Please take a few minutes to fill out this questionnaire and return it to your math instructor. Try to answer every question. Thank you for your cooperation.

Name _____ Sex M F Age _____

Soc. Sec.# _____ Brookdale program, if known _____

MTH 100 Section _____ Career goal, if known _____

Instructor _____

Date of application to Brookdale (approximate) Month _____ Year _____

1. Best description of the last math course you took:
   a. MTH 100 at Brookdale
   b. General or Business Math (high school)
   c. Algebra I
   d. Geometry
   e. Algebra II
   f. Trigonometry
   g. Math Analysis
   h. Other (describe) _____

2. How long ago did you take the math course indicated in question 1?
   a. within the last year
   b. 1 - 3 years ago
   c. 3 - 5 years ago
   d. 5 - 10 years ago
   e. 10 or more years ago

3. Approximate number of college credits earned to date (do not include credits you are currently taking).
   a. 0 - 12
   b. 12 - 20
   c. 20 - 30
   d. 30 - 45
   e. 45 or more

4. Number of credits enrolled in this term. (including MTH 100)
   a. 3 or fewer
   b. 4 - 6
   c. 7 - 9
   d. 10 - 12
   e. 13 or more

5. Current work commitment - approximate number of hours per week.
   a. 0
   b. 1 - 6
   c. 7 - 12
   d. 13 - 20
   e. 21 -30
   f. 31 - 40
   g. 40 or more

6. Your best recollection of your high school grades.
   a. mostly A's
   b. mostly A's and B's
   c. mostly B's and C's
   d. mostly C's and D's
   e. mostly D's and F's

7. Your best recollection of your high school math teachers (circle as many as apply)
   a. helpful
   b. friendly
   c. strict
   d. uncaring
   e. boring
   f. fun
   g. unfair
   h. don't remember
   i. good explainer

8. Transportation (best description) to Brookdale
   a. I drive my own car
   b. I drive a car I share with at least one other person
   c. I'm in a car pool
   d. Someone else drives me
   e. I use public transportation
   f. I haven't made any regular arrangements yet

9. Indicate if you are now enrolled in any of the following (check as many as apply)

   _____REA 100

   _____MLE courses (English as a second language)

   _____ENG 100

   _____HUD 107, 108 or 109

Please indicate on the scale to what extent you agree or disagree with the following statements.

Strongly Disagree Disagree Neutral Agree Strongly Agree

1. Math is an easy subject for me.

   SD D N A SA

2. If I spend a lot of time on a math problem, I can usually solve it.

   SD D N A SA

3. I tend to procrastinate when I have to do something I don't like.

   SD D N A SA

4. Math is very relevant to my career goals.

   SD D N A SA

5. I've had a lot of bad luck in school in the past.

   SD D N A SA

6. I enjoy doing math problems.

   SD D N A SA

7. Men are much better at math than women are.

   SD D N A SA

8. I've always had a "mental block" about math.

   SD D N A SA

9. I have trouble taking tests.

   SD D N A SA

10. I don't usually ask questions in a math class because I'm afraid I'll sound stupid.

    SD D N A SA

11. I need some help with my study habits.

    SD D N A SA

12. My grades on math tests do not accurately reflect what I really know.

    SD D N A SA

13. Learning math is very different from learning other subjects.

SD D N A SA

14. I'm quite certain of my career goal.

SD D N A SA

15. Most people I know are better in math than I am.

SD D N A SA

16. I've always enjoyed school.

SD D N A SA

17. I enjoy being with people.

SD D N A SA

18. I have a "mechanical mind".

SD D N A SA

19. It's easy for me to visualize an object that someone describes to me.

SD D N A SA

20. I can accurately estimate quantities and distances.

SD D N A SA

21. Doing math makes me anxious and tense.

SD D N A SA

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